Math 2280-01 Introduction to Differential Equations

Summer 2018

Instructor: Qing Xia, Office: JWB 107, Email: xia@math.utah.edu

Lecture Time and Location: 10:00am–11:00am, LCB 215 (MTWH)

Office hours: Tuesday and Wednesday: 11:00am-12:00pm, JWB 107

Dates

- Class begins, Monday, May 14, 2018
- Two Midterms, Thursdays: Jun. 7 and Jul. 5, 2018, LCB 215
- Final: Friday, August 3, 2018, 10:00am–12:00pm, LCB 215
- Last day of class: Wednesday, August 1, 2018
- Memorial Day holiday: Monday, May 28
- Independence Day holiday: Wednesday, July 4
- Pioneer Day holiday: Tuesday, July 24

Textbook

Differential Equations and Boundary Value Problems, Computing and Modeling, 5th edition, by Edwards and Penney. ISBN=978-0-321-79698-1.

Homework

- Homework is assigned each lecture and collected weekly. The assignments will be due on Thursdays at the beginning of class.
- Late homework is not accepted.
- Homework solutions that are not stapled will not be accepted.
- Homework with spiral bound notebook fringe will not be accepted.
- Solving and writing out solutions to homework problems is where most of your learning will take place. Take pride in your work.

Quizzes

15-20 minutes Quiz will be on each Thursday at the end of class (if there is no midterm that day).

Grading Policy

The grades will be calculated as follows: Homework 25%, Quizzes 15%, 2 Midterms 30%, Final Exam 30%.

The grade scale will be : A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C+ (77-79), C (73-76), C- (70-72), D+ (67-69), D (63-66), D- (60-62), E (0-59).

There will be no extra credits, partial credits, rounding up, late homework or makeup exams.

Prerequisite

Linear Algebra, Math 2270. Although not a prerequisite, 2280 students would benefit from having taken multivariable calculus, 2210. They need an understanding of curves and tangent vectors to understand the geometric meaning of solutions of a system of differential equations. It is also important for them to have an understanding of partial derivatives.

Course Description

Linear and nonlinear differential equations and systems of equations, with applications. Matrix exponential, fundamental solution matrix, phase-space and portraits, stability, initial- and boundary-value problems, introduction to partial differential equations. Requires familiarity with linear algebra. Includes theoretical and computer lab components.

Learning Objectives

Math 2280 is an introduction to ordinary differential equations, and how they are used to model problems arising in engineering and science. It is the second semester of the year long sequence 2270-2280, which is an in-depth introduction to linear mathematics. The linear algebra which you learned in Math 2270 will provide a surprising amount of the framework for our discussions in Math 2280, although this will not be apparent at first.

The semester begins with first order differential equations: their origins, geometric meaning (slope fields), analytic and numerical solutions, in Chapters 1-2. The logistic equation and various velocity and acceleration models are studied closely. The next topic area, in Chapter 3, is linear differential equations of higher order, with the principal application being mechanical vibrations (friction, forced oscillations, resonance). This is about the time your linear algebra knowledge will start being helpful.

Next we show how models of more complicated dynamical systems lead to first and second order systems of differential equations (Chapter 4), and study Eulers method for numerical solutions to help understand existence and uniqueness of solutions. We use eigenvalues and eigenvectors, matrix exponentials and general vector space theory, to explicitly solve these problems in Chapter 5. The concepts of phase plane, stability, periodic orbits and dynamical-system chaos are introduced with various ecological and mechanical models, in Chapter 6. The study of ordinary differential equations concludes with an introduction to the Laplace transform, in Chapter 7.

The final portion of Math 2280 is an introduction to Fourier series. We will use them to re-study general forced oscillation problems, and may have time to survey some applications to the classical partial differential equations: the heat, wave and Laplace equations. This material is covered in Chapter 9 of the text.

Tentative Week-by-week guide of topics and textbook sections

Topic schedule is subject to slight modifications as the course progresses, but exam dates are fixed.

- Week 1: 1.1,1.2,1.3,1.4;
- Week 2: 1.5,1.6,2.1,2.2;
- Week 3: 2.3,2.4,2.5;
- Week 4: 2.6,3.1,3.2,3.3; **Midterm 1**
- Week 5: 3.4,3.5,3.6,3.7;
- Week 6: 4.1,4.2,5.1,5.2;
- Week 7: 5.3,5.4,5.5,5.6;
- Week 8: 5.7,6.1-6.2; **Midterm 2**
- Week 9: 6.3,6.4,7.1-7.2
- Week 10: 7.3,7.4,9.1,9.2;
- Week 11: 9.3,9.4
- Week 12: 9.5,9.6; **Final Exam**

Other Policies

- Cheating: You'll receive 0 points if caught cheating in homework or exams; The act of cheating in exams will be reported.
- Behavior in class is required.
- Attendance is encouraged in lectures and mandatory for labs.

Strategies for success

- Attend class regularly.
- Read or at least scan the relevant text book sections and lecture note outlines before you attend class.
- Ask questions and become involved.
- Plan to do homework daily; try homework on the same day that the material is covered in lecture; do not wait until just before homework and lab reports are due to begin serious work.
- Form study groups with other students.

ADA Statement

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services (CDS), 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and me to make arrangements for accommodations. All information in this course can be made available in alternative format with prior notification to CDS.

Student Responsibilities

All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. You have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, collusion, fraud, theft, etc. Students should read the Code carefully and know you are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee. http://regulations.utah.edu/academics/6-400.php